Total Pages—4

B.Tech - 6th   (Set-R₁)

Refractories and Furnaces

Full Marks : 70

Time : 3 hours

Q. No. 1 is compulsory and answer any
five from the rest questions

The figures in the right-hand margin indicate marks

1. Answer *all* the questions :   2 × 10

    (a) Classify different types of fuel based on occurrence and give examples of each type.

    (b) Define Carbonization.

    (c) What is ferro-coke ? What are the advantages of using ferro-coke ?

    (d) What is caking index of coal and how is it determinied ?

    (e) State and explain different requirements of combustion.

    (f) What is reactivity of coke ? What are the methods of determining the reactivity of coke ?

    (g) What is adiabatic flame temperature and how is it different from theoretical adiabatic flame temperature ?

    (h) Calculate amount of air required for theoretically complete combustion of $100 \, Nm^3$ of blast furnace gas of the following composition (by volume %)

$$CO_2 = 17, CO = 22 \cdot 1, H_2 = 4 \cdot 9,$$
$$N_2 = 55 \cdot 8, O_2 = 0 \cdot 2$$

    (i) How percentage volatile matter of coal is determined ?

    (j) Define ignition temperature. How ignition temperature of coke is determined ?

2. (a) Define carbonization and differentiate between Low Temperature carbonization (LTC) and high Temperature carbonization (HTC).   6

(b) A sample of coal was analyzed as follows :
Exactly 2·5 gm of sample was weighed in a silica crucible. After heating for one hour at 110°C, the residue weighed 2·415 gm. Next, the crucible was covered with a lid and strongly heated for 7 minutes at 950°C. The residue weight 1·528 gm. The crucible was then heated without the cover, until a constant weight was obtained. The last residue was found to weight 0·245 gm. What type of analysis is this ? Calculate the percentages results of the above analysis.   4

3. (a) Explain the working principle of Bomb Calorimeter with proper schematic.   5

(b) Explain Otto-Hoffman's process of coke making.   5

4. (a) Define refractory and elaborately classify them. What is the importance of pyrometric cone equivalent ?   5

(b) Write the general manufacturing process of refractory.   5

5. Volumetric composition of a producer gas is as follows : $N_2 = 54\%$, $H_2 = 12\%$, $CO = 29\%$, $CO_2 = 5\%$. Assume complete combustion. Determine (i) Stoichiometric amount of air, (ii) Amount of POC. (iii) POC analysis (wet basis), (iv) POC analysis (dry basis) and (e) POC analysis (Orsat). Basis of calculation is 100 m³ of producer gas.   10

6. Write short notes in :   5 + 5

   (i) Inflammability limits

   (ii) Types and structures of flame.

7. State and explain different types of gaseous fuel burners.   10

8. Write short notes in :   5 + 5

   (i) Fireclay refractory

   (ii) Dolomite refractory.

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